

MATERIALS SCIENCE & ENGINEERING

DANGER - HIGH VOLTAGE



The world is experiencing a materials revolution. Advances in materials have preceded almost every technological leap since the beginning of civilization and engineered materials are crucial to the continued vitality of countless industries. The University of Washington's Materials Science & Engineering Department is at the heart of this revolution preparing our students and conducting research to meet the needs of modern technology.

MSE EDUCATION

Preparing students for successful careers is our highest priority. Our graduates find employment in aerospace, automotive, biomedical, chemical, construction, electronics, energy and numerous other fields.

DEGREE PROGRAMS

Bachelor of Science (BS) - prepares students for graduate work or careers in industry, government, or academia.

Master of Science (MS) - prepares students for advanced careers in industry and academia along with future PhD studies.

Doctor of Philosophy (PhD) - trains engineers for leadership roles in academia, industry and research institutions.

STUDENT DEMOGRAPHICS

Undergraduate enrollment: 126 | Bachelor's degrees awarded 2023: 44

Graduate enrollment: 182 | Master's degrees awarded 2023: 50

Doctoral degrees awarded 2023: 12

DIVERSITY OF DEGREE RECIPIENTS	BS	MS/PhD
Women	38%	37%
Underrepresented Minorities*	9%	13%
International Students	6%	37%

*African American, Hispanic American, Native American and Hawaiian/Pacific Islander

UNDERGRADUATE LEARNING

Program Features

We offer an ABET-accredited Bachelor of Science (BS) program. The department graduates the highest number of undergraduate students per faculty member among peer departments nationwide.

Unique aspects of our program include:

- Active student professional organizations
- Diverse student body
- Small class size
- Hands-on, team-based learning
- Undergraduate research projects
- A combined BS/MS program for well-qualified undergraduate students

Excellence

Our undergraduate students win a variety of awards and scholarships.

- Dean's Medal for Academic Excellence
- WRF Capital First Place Prize in 2022 Holloman Health Innovation Challenge
- Perkins Cole Best Innovation/Technology Prize in 2022 Dempsey Startup Competition
- NSF Undergraduate Research Fellowships
- UWEB Scholarships
- UW Mary Gates Scholarships
- Husky Promise Scholarships
- SAMPE Scholarships
- NASA Space Grant

GRADUATE LEARNING

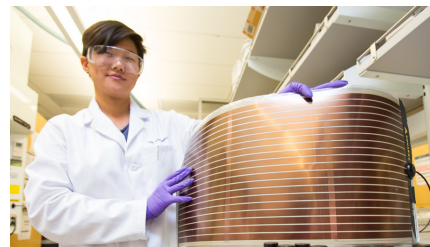
Program Features

We offer an outstanding Master of Science (MS) and Doctor of Philosophy (PhD) program. Our students perform cutting-edge, interdisciplinary research on biomaterials for tissue engineering, ceramics and polymers for energy applications, composites and metals for aerospace, genetically engineered molecules, and semiconductors for electronics. Additional program features include:

- Educational and research training involving synthesis, processing, characterization and fabrication of all classes of materials using state-of-the-art research equipment and facilities
- Doctoral dissertation research opportunities for leading-edge, interdisciplinary work
- Research and teaching assistantships, stipends and fellowships for our doctoral program
- Faculty collaboration for a final project, thesis or internship for our master's program

Excellence

MSE doctoral students receive many fellowships from the department, College of Engineering and the Graduate School including Washington Research Foundation, CoMotion PEP, Renewable Energy Scholarship Foundation, National GEM Consortium, NASA, TMS (Minerals, Metals & Materials Society), and the NSF Advanced Study Institute Project



FACULTY

Composition

- 23 core faculty members
- 12 adjunct faculty members
- 25 affiliate faculty members
- 10 postdoctoral researchers

Achievements

In recent years, our faculty members earned the following honors:

- 2023 MSA Fellow
- 2023 Research award from M.J. Murdock Charitable Trust
- 2022 Clarivate Highly Cited Researchers
- 2021 Research award from Federal Aviation Administration (FAA)
- 2019 Research Award from NSF
- 2019 Research Award from DOE

RESEARCH AND INNOVATION

Our students and faculty conduct research in a variety of areas. Many of the research topics are interdisciplinary and involve participation from other engineering, basic science and medical disciplines.

Active Nanoscale Material Systems

Bruce Hinds focuses on reinventing engineering membranes to become active nanoscale devices. These are based on biomimetic nanopores with active gatekeepers and nano-electrode architectures. Application areas include energy storage, environment, biochemical conversions/separations, and medical devices.

Advanced Materials for Energy Storage and Conversion

Jihui Yang uses various experimental and theoretical techniques to design, synthesize, test, and understand advanced thermoelectric materials and Li-ion battery materials for energy conversion and storage.

Advanced Structural Materials

Dwayne Arola focuses on the structure-property relationships of natural and engineered materials, with emphasis on fatigue, fracture behavior and the mechanisms of degradation posed by aging, environment and synergistic processes.

Biomaterials: Nanoparticles and Tissue Engineering

Miqin Zhang combines the study of biomaterials and materials science to explore the interactions between materials and biological systems and develop materials and devices for biological and medical applications.

Biomaterials: Polymers from Renewable Resources

Eleftheria Roumeli converts plants and algae into biopolymers capable of mimicking synthetic polymers like plastic. Her research delivers state-of-the-art, high-performance nanocomposite materials that could make a meaningful impact for sustainability.

Composite Materials

Navid Zobeiry explores the intersection of materials science, data science, and manufacturing technologies. He is particularly invested in the development and characterization of new and improved material systems, including AI-enhanced manufacturing methods.

Computational Materials

Lucien Brush focuses on mathematical modeling of material behavior in processes that involve phase transitions, interfacial phenomena and thin film hydrodynamics.

Magnetism, Nanosciences and Bioengineering

Kannan Krishnan works at the intersection of magnetism, materials and medicine focusing on diagnostics, imaging and therapy, with appropriate translational research and commercialization activities. He also emphasizes nanoscale magnetic/transport phenomena and advanced characterization methods to develop new materials and devices for information and energy technologies.

Nanomaterials for energy related applications

Guozhong Cao examines the chemical processing of nanostructured materials for energy related applications including solar cells, batteries and supercapacitors as well as actuators and sensors.

Nanoscale Optoelectronic Materials

Peter Pauzauskie explores basic materials science and engineering research to design, synthesize, and characterize nanoscale optoelectronic materials with unique compositions and morphologies.

Nanoscale Optoelectronics

Xiaodong Xu aims to understand the optical, electronic and quantum properties of novel solid state nanostructures through nanoscale device design, optical spectroscopy, electrical transport, and scanning photocurrent measurements.

Quantum Computing, Chaos and Electronics

Charlie Marcus aims to understand the optical, electronic and quantum properties of novel solid state nanostructures through nanoscale device design, optical spectroscopy, electrical transport, and scanning photocurrent measurements.

Quantum Materials in Extreme Environments

Matthew Yankowitz specializes in the investigation and control of novel electronic states in quantum materials by exposing them to low temperatures and high magnetic fields. His primary focus is on atomically-thin van der Waals materials and heterostructures.

Scalable Printed Electronics and Energy Devices

Devin MacKenzie researches solution-processible nanoscale, organic and ionic materials and their scalable processing via roll-to-roll deposition, nanopatterning and large area printing. These advanced materials, low energy and cost manufacturing approaches are used to create printed solarcells, batteries, sensors, and 3D and flexible electronics.

Topological Properties of Materials

Juan Carlos Idrobo develops and applies novel analytical electron spectroscopy and imaging techniques to determine how materials behave at the atomic level. His research led to the first experimental measurement of temperature at the nanoscale, as well as the first detection of isotopes in water and amino acids at the nanoscale using vibrational electron energy loss spectroscopy.

Centers for Excellence

The department is a lead partner or a core member in the following interdisciplinary centers:

- Institute for Nano-Engineered Systems (NanoES)
- Molecular Engineering & Sciences Institute (MoES)
- Genetically Engineered Materials Science and Engineering Center (GEMSEC)
- Center of Excellence for Advanced Materials in Transport Aircraft Structures (AMTAS)
- Materials and Devices for Information Technology Research (MDITR) Science and Technology Center

TRAILBLAZERS

Many notable figures in materials industry and education hold degrees from the Department of Materials Science & Engineering. Here are just a few outstanding examples of alumni achievement.



Stephen T. Ching (BS '72 Ceramic Engineering)

Stephen Ching is co-founder, president and VP of engineering at Isolink Inc., the leading supplier of optoelectronic radiation-tolerant components worldwide for military, aerospace, hybrid, industrial, medical and telecommunications markets. The company pioneered the miniaturization of some of the most advanced optoelectronic components. Before founding Isolink, Stephen worked for Fairchild Semiconductors Linear Integrated Circuits and Hewlett Packard's optoelectronics division.



Tom H. Delimitros (BS '63, MS '66 Ceramic Engineering)

2001 MSE Distinguished Service Award
1993 College of Engineering Diamond Award for Distinguished Service

Tom Delimitros was a founding general partner of three advanced material technologies venture funds from 1989 to 2011. Currently, he is at Delventec Investments, his personal investment vehicle, and serves on the boards of Photodigm, Inc. and TRS Group Inc., among others. Tom served on the board of the UW Foundation, and as chairman of the MSE External Advisory Board. As the leader of the MSE Initiative, he helped to raise \$2.5 million to build Mueller Hall and equip new labs, and established the Tom H. Delimitros Fellowship for MSE.



Bonnie J. Dunbar (BS '71, MS '75 Ceramic Engineering)

1999 MSE Distinguished Service Award
2004 UW Alumna Summa Laude Dignata
2012 College of Engineering Diamond Award for Distinguished Service

A veteran of five space missions as a NASA mission specialist astronaut, Bonnie Dunbar flew aboard the space shuttles Atlantis, Challenger, Columbia and Endeavor. Previously she served as a NASA mission controller, and held research and engineering positions at Boeing, Harwell Laboratories in the UK and Rockwell International. After retiring from NASA in 2005, Bonnie served as president and CEO of the Museum of Flight in Seattle and as director of higher education and STEM at The Boeing Company. She is a member of the National Academy of Engineering and has received numerous awards and honors.



“We have seen rapid growth in faculty hiring in recent years, which has led to diverse and vibrant research. We are better poised than ever to find innovative solutions to the materials challenges faced by modern society. Our goal of developing a new generation of materials science engineers is also bolstered by strong investment from both the state and federal government.”

-Di Xiao, Chair and Professor, Materials Science & Engineering



Alain Adjorlolo (BS '79, MS '81, PhD '85)

2023 College of Engineering Diamond Award for Translating Innovation into Impact
2023 MSE Distinguished Service Award

Alain Adjorlolo has built a career and reputation for technical advances that have influenced modern aircraft design and advanced sustainability across the industry. His design of a corrosion risk assessment tool is now industry standard, and he holds 10 granted patents and 11 patent applications on corrosion inhibitors, adhesives and composites. In 2022, Adjorlolo was named a Technical Fellow at Boeing. He received the Black Engineer of the Year Award in Outstanding Contribution in Industry category from US Black Engineer and Information Technology in 2020 and was featured in Innovation Quarterly in 2021.



Mohan S. Misra (BS '70 Metallurgical Engineering)

2013 MSE Distinguished Service Award

Mohan Misra founded ITN Energy Systems, Inc. in 1995 to research, develop and commercialize emerging technologies in energy, environment and space. Previously he led Materials Research & Technology at Martin Marietta Aerospace, developing thin-film photovoltaics, smart materials and structures, advanced composites, lightweight structures and solar arrays for aerospace applications. He has over 10 patents, 40 technology idea disclosures and over 100 technical publications.



Bo Zhao (PhD '17)

Bo Zhao is a 2017 graduate with a dual Ph.D. degree in MSE and Nanotechnology, and an M.S. degree in Chemistry at UW. Bo began his professional career in nanofabrication at Micron Technology Inc. as a photolithography R&D engineer developing 3D-NAND, where he held several patents for novel patterning of staircase structure. After 3.5 years at Micron, he joined a world class team of scientists at Meta to shape the future of Augmented Reality. Beyond his passion for technology innovation, Bo has also brought opportunities from industry for both the students and the faculty that lead to several sponsorships, fundings, research collaborations, capstone projects, mentorships, and hirings.

